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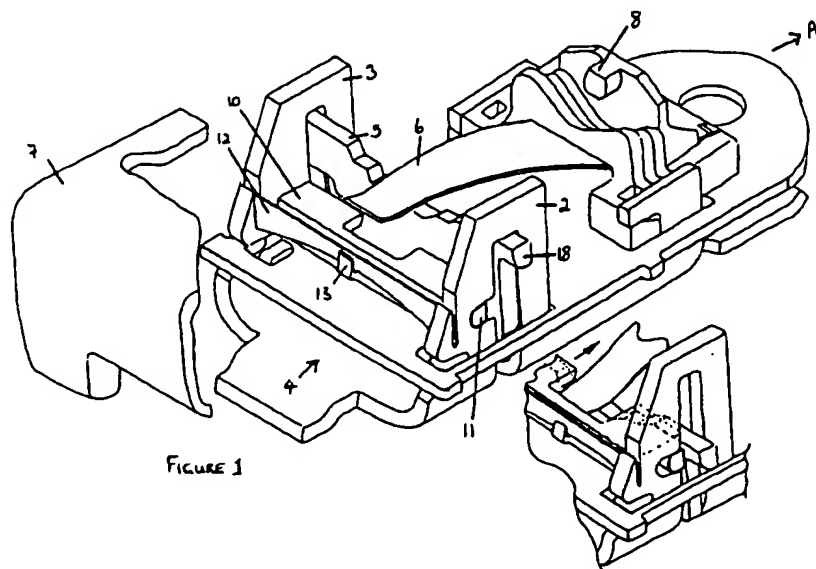
(58) Field of Search

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(54) Abstract Title

Safety belt buckle for use with a pretensioner

(57) The buckle for a vehicle safety restraint belt comprises a latch 5 moveable between a tongue engaging position in which the buckle is fastened and a tongue disengaged position in which the buckle is open, a button 7 moveable in the direction of tongue insertion to lift the latch against the action of a biasing spring, into the disengaging position. A securing means in the form of a slidable plate 10 is mounted in the buckle frame and is moveable between a position in which it restrains a movement of the latch into the disengaging position and a position in which it does not restrain movement of the latch. The securing plate is biased to the unrestraining position by a leaf spring 12 or a coil spring, the strength of which is chosen so as to be overcome during the deceleration phase of a pretensioner so that the securing plate moves to the restraining position and prevents opening of the buckle but so that when pretensioning forces dissipate, the securing plate moves back to the un-restraining position.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1995
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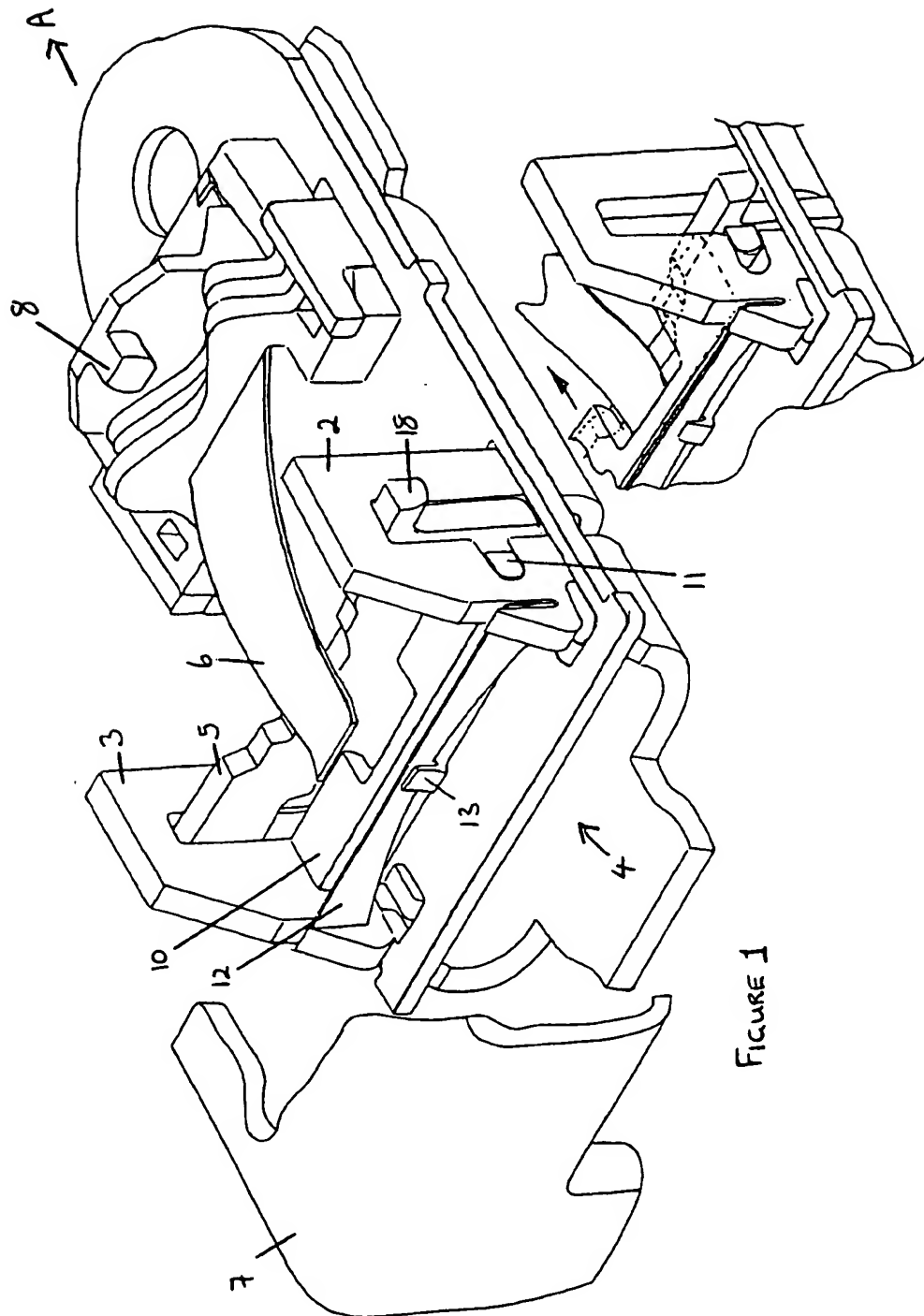


FIGURE 1

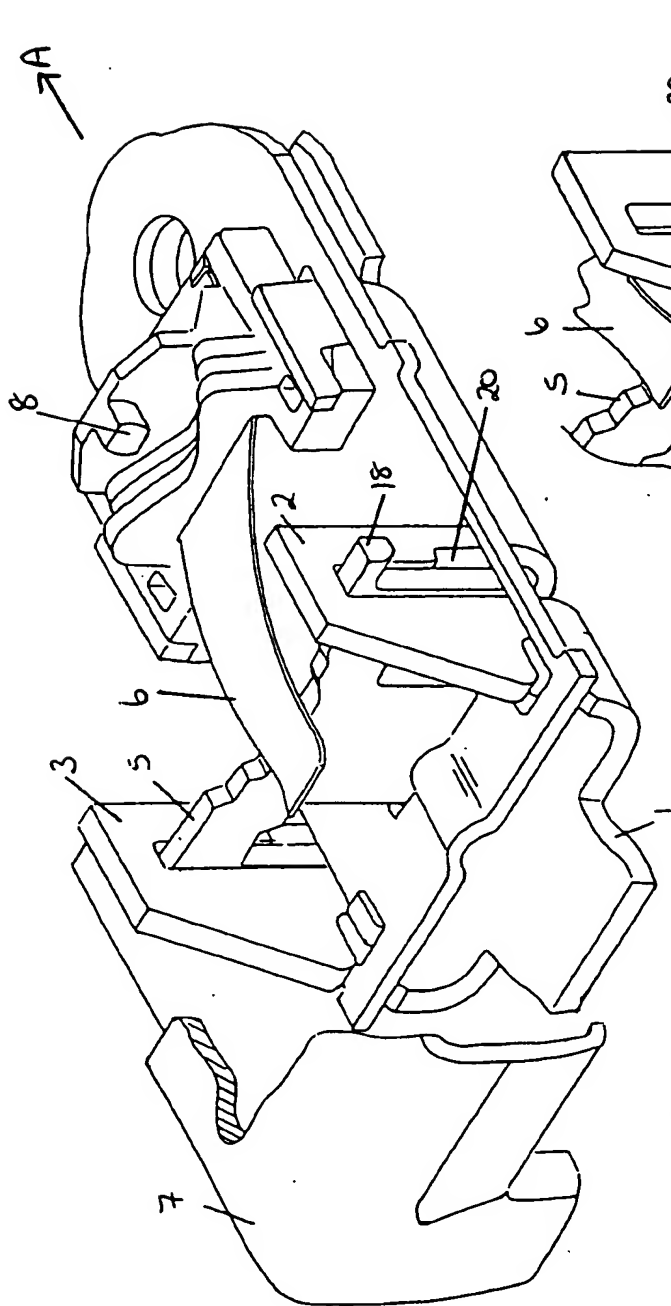


FIGURE 2a

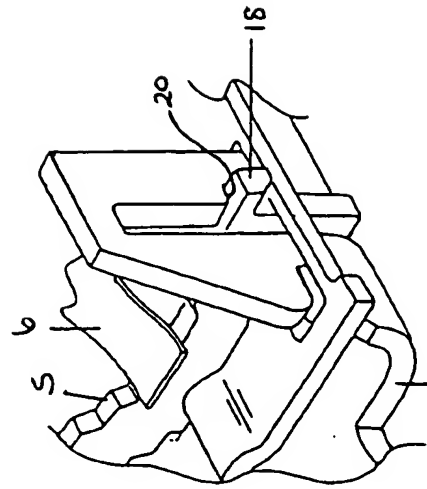
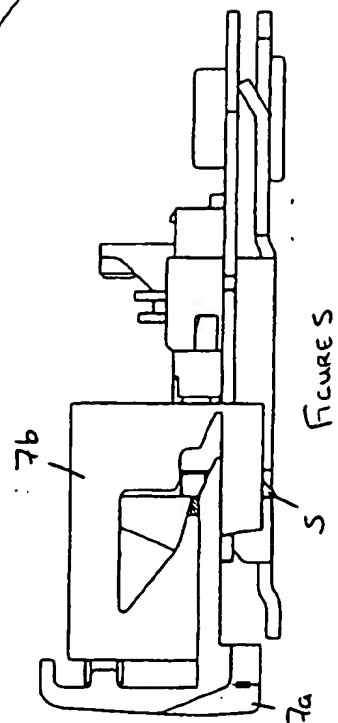
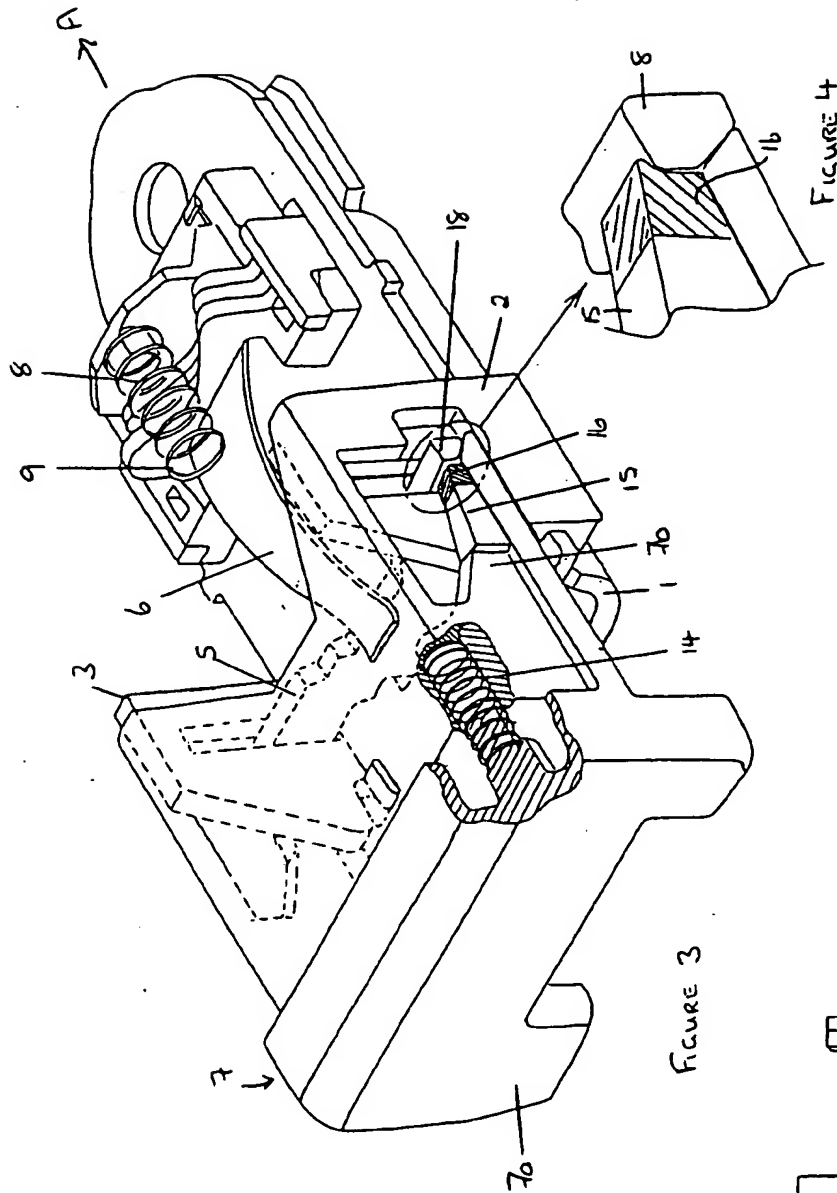


FIGURE 2b



SAFETY BELT BUCKLEDESCRIPTION

The present invention relates to a safety belt buckle
5 and particularly to a buckle for use with a buckle end
pretensioner.

Pretensioners are used to rapidly pull back the buckle
mounting so as to rapidly take up any slack in the seat belt
10 holding the vehicle occupant in position. Slack can arise
if the occupant is out of position (for example asleep!) or
from loose windings on the retractor (so called spool film
effect). The buckle is pulled back very quickly and thus
extremely high G-forces are exerted on the buckle parts. A
15 conventional buckle tends to unlatch under the influence of
these high G-forces because of relative motion between parts
of the buckle due to their different inertias. For example
some parts may lag behind the buckle frame during the
accelerating phase of the pretensioning operation. Other
20 parts keep moving after the frame of the buckle has been
stopped (this is deceleration phase of the pretensioning
operation). In particular, during the deceleration phase
the actuating button of the buckle keep moving and acts in
the same way as if was being depressed, to open the buckle.
25 Obviously this is highly undesirable and it is an object to
the present invention to provide a buckle which is immune to
the high G-forces generated during pretensioning.

One known pretensioner proof buckle is disclosed in EP
30 681 792. Here a pin type catch is loaded by a compression
spring to a retracted position during normal operation of

the buckle. However under pretensioning the retraction force of the spring is overcome by the high G-forces during the acceleration phase and the pin is moved into a blocking position over the buckle latch. At the end of the
5 pretensioning stroke, i.e. during the deceleration phase the button tries to move into a de-latching position and the force exerted by the button on the latch jams the pin in its blocking position. Thus theoretically the buckle does not open.

10

However this mechanism relies on parts of the buckle jamming together and this sometimes locks up the buckle totally so that it cannot be released after the pretensioning operation is complete. This is obviously
15 highly undesirable since in that case the vehicle occupant cannot be released from the seat.

It is an object of the present invention to provide an improved pretensioner proof buckle which does not jam on
20 use.

According to the present invention there is provided a buckle for a vehicle safety restraint belt comprising a latch moveable between a tongue engaging position in which
25 the buckle is fastened and a tongue disengaged position in which the buckle is open, a button moveable in the direction of tongue insertion to lift the latch against the action of a biasing spring, into the disengaging position, a securing means mounted in the frame of the buckle to be moveable
30 between a position in which it restrains a movement of the latch into the disengaging position and a position in which

it does not restrain movement of the latch, the securing means being biased to the unrestraining position by resilient means, the strength of the resilient means being such as to be overcome during the deceleration phase of a pretensioner so that the securing means moves to the restraining position and prevents opening of the buckle and when pretensioning forces dissipate, the securing means moves back to the un-restraining position.

10 Preferably the biasing means is a leaf spring held at its ends in slots in the buckle frame and its centre in a slot or by a hook mounted on the securing means. The securing means is preferably a slidable plate mounted for a sliding movement in slots in the frame. The latch is
15 preferably biased to the tongue engaging position by a leaf spring.

A buckle constructed according to the present invention has significant advantages over the prior art because the
20 securing means moves into the latch restraining position during the deceleration phase of the pretensioning operation and thus the danger of the buckle jamming is significantly reduced.

25 Of course a coil spring may be used instead of a leaf spring to bias the securing means.

In the preferred embodiment in which the securing means is held in the frame of the buckle, this pretensioning
30 overlocker is very strong and can withstand the extremely high loads that are applied to the button assembly under

pretensioning. In one embodiment the securing means is made lighter than the button. The securing means moves faster than the button during the deceleration phase and blocks the latch before the button exerts opening forces on the latch.

5 The ratio of the spring strength to the mass of the securing means controls this operation. Typically the securing means is only half the mass of the button and the spring is arranged so that the force needed to overcome the inertia of the button is a multiple, up to around nine times, the force

10 needed to overcome the inertia of the securing means.

According to an alternative embodiment, the latch is allowed to travel a small distance under pretensioning conditions but is inhibited from lifting fully out of tongue

15 engagement by a section in the lower frame by a spring loaded mass assembly behind the latch maintaining the position of the latch in normal conditions. When the arrangement is under load during pretensioning then the securing means is moved into position by a calibrated spring

20 which is set so that blocking of the latch is achieved prior to the button moving.

According to yet another alternative embodiment the button is formed in two sections which move together under

25 normal working conditions. However under pretensioning conditions the inner button is allowed to move prior to the outer button since it is made heavier and thus has higher inertia. The inner button has a small abutment which under pretensioning conditions fits over or clamps against the

30 latch and prevents it from lifting and unlocking the buckle. Preferably this abutment comprises a composite material with

a much higher friction coefficient than the normal material used for a button. The mass of the inner button and the value of the calibration spring counteract the forces apply by the outer button to try to lift the latch and disengage
5 the buckle.

For a better understanding of the present invention and show how the same may be carried into effect reference will now be made to the accompanying drawings in which:

10

Figure 1 is a part cut away perspective view of a buckle according to one embodiment of the present invention;

15

Figure 2a is a part cut away perspective view of a buckle according to a second embodiment of the present invention and figure 2b is an enlarged view of part of figure 2a;

20

Figure 3 is a part cut away perspective view of a third embodiment.

Figure 4 is an enlarged view of part of Figure 3 showing a modification.

25

Figure 5 is a side cross-sectional view of the embodiment of Figure 3.

The buckle used in the present invention is a sliding
30 latch buckle of generally known construction. The basic principles of this buckle are well known to those skilled in

the art.

The buckle comprises a load bearing frame 1 of a generally U-shaped form with upstanding arms 2 and 3. A channel 4 for insertion of the buckle tongue is formed in a recess of the frame. A tongue engaging latch 5 is mounted in slots in the arms 2 and 3 of the frame and can slide up and down in these slots so as to engage the tongue in the lower position and disengage the tongue in its upper position. It is biased to the lower tongue engaging position by a leaf spring 6 and is lifted up against this bias by ramps (not shown) on the outer sides of actuating button 7. The button ramps engage the outwardly extending shoulders 18 on the latch 5.

15

A return spring for the button 7 is mounted on boss 8 at the back of the frame 1. The spring itself is not shown in figure 1 but is shown in figure 3.

20 The buckle is made pretensioner proof by a sliding securing means 10. The securing means takes the form of a sliding plate engaging generally horizontal slots 11 in the upstanding arms 2 and 3 of frame 1. This securing plate is biased to the position shown in Figure 1 by a leaf spring 12 which is secured at its ends in the upstanding arms 2 and 3 of frame 1 and at its centre by a hook 13 on sliding plate 10. In this position the latch 5 is free to move up and down into and out of a tongue engaging position and thus normal operation of the buckle is unchanged by the addition
30 of this plate 10.

However under pretensioning conditions the buckle mounting is pulled rapidly in the direction A during the acceleration phase of pretensioning the button 7, as also the plate 10, have a potential to lag behind the frame 1. In practice there is no actual movement since the button 7 is prevented from relative motion outwardly of the frame by stops on the frame (not shown). The plate 10 is prevented from relative rearward movement by the end surface in horizontal slots 11 in the frame 1.

10

At the end of the acceleration phase, the frame is stopped from motioning direction A abruptly. However the inertia of the button and of the plate 10 cause them to continue moving in direction A. The ratio of the spring force to the mass of the plate 10, compared to the mass of the button 7, allows the plate 10 to overcome the bias of the spring 12 and to move, relative to the frame 1, in direction A. This puts it in a position sitting over the latch 5 and preventing the latch from lifting. The button 7 also tries to move in the direction A and the ramps on the button exert an upward force on the lugs 8 of the latch 5. The latch 5 is prevented from moving upwards by the plate 10 and thus the buckle remains closed. By way of example, the button mass would typically be 7 grams, the plate 3 gms. Hence the force to react against the button is 5.6N and that for the plate is 0.6N. The ratio is 9:1 but other ratios would work.

When the pretensioning forces have dissipated, the spring 12 returns the plate 10 to its uninhibiting position (as shown in Figure 1) and the buckle can be operated as

normal.

Figures 2a and b shows an embodiment in which extra cut
outs 20 are formed on the upstanding arms 2 and 3 of the
5 load bearing frame 1. Under pretensioning conditions the
latch 5 moves in the direction A relative to the frame 1 and
the outwardly extending shoulders 18 of the latch 5 engage
into these cut outs 20 as shown more clearly in Figure 2b.
This prevents the latch from lifting out of engagement with
10 the tongue.

Figure 3 shows another alternative embodiment. Like
parts are denoted by like reference numerals. In this case
the button 7 is formed of two parts. A front, outer part 7a
15 provides the surface on which a manual actuation of the
button is made, i.e. on which the user presses. Rear or
inner part 7b is connected to part 7a by a calibration
spring 14.

20 Under normal operation the outer 7a and inner part 7b
of the button 7 move together and ramps 15 engage the
outwardly extending arms 18 of the latch 5 to lift the latch
against the bias of the leaf spring 6.

25 Under pretensioning conditions, the inner button 7b
moves slightly faster than the outer button 7a (since it is
formed with a higher mass). This is during the deceleration
phase of the pretensioning. Under these conditions the
front portion 16 of ramps 15 abut the latch 5 in the region
30 of arms 18. This portion 16 is preferably made of a
material having a high coefficient friction, for example

some type of composite material and thus the force of the inner button 7b pressing against the side of arms 18 of latch 5 is sufficient to retain the latch in the tongue engaging position and prevent the buckle from opening.

5

Figure 4 shows a modification in which the portion 16 is shaped so as to have a slight overhang 17 to more securely restrain the arms 18 of the latch 5.

10

Figure 5 is a cross-sectional view of the embodiment of Figure 3 and like parts are denoted by like reference numbers.

CLAIMS

1. A buckle for a vehicle safety restraint belt,
5 comprising:

a latch moveable between a tongue engaging position in
which the buckle is fastened and a tongue disengaged
position in which the buckle is open;

10

a button moveable in the direction of tongue insertion
to lift the latch into the disengaging position against the
action of a biasing spring;

15 a securing means mounted in the frame of the buckle to
be moveable between a position in which it restrains a
movement of the latch into the disengaging position and a
position in which it does not restrain movement of the
latch,

20

the securing means being biased to the unrestraining
position by resilient means, the strength of the resilient
means being such as to be overcome during the deceleration
phase of a pretensioner so that the securing means moves to
25 the restraining position and prevents opening of the buckle,
and when pretensioning forces dissipate, the securing means
moves back to the un-restraining position.

2. A buckle according to claim 1 wherein the biasing
30 means is a leaf spring held at its ends in slots in the
buckle frame and held at its centre by means mounted on the

securing means.

3. A buckle according to claim 2 wherein the means mounted on the securing means is a slot.

5

4. A buckle according to claim 2 wherein the means mounted on the securing means is a hook.

5. A buckle according to any preceding claim, wherein
10 the securing means is a slidable plate mounted for a sliding movement in slots in the frame.

6. A buckle according to any preceding claim wherein the latch is biased to the tongue engaging position by a
15 leaf spring.

7. A buckle according to any one of claims 1 to 5 wherein the latch is biased to the tongue engaging position by a coil spring.

20

8. A buckle according to any one of the preceding claims wherein the securing means is lighter than the button.

25 9. A buckle according to claim 8 wherein the securing means has a mass which is approximately half the mass of the button.

10. A buckle according to claim 8 or 9 wherein the
30 spring is arranged so that the force needed to overcome the inertia of the button is a multiple of the force needed to

overcome the inertia of the securing means.

11. A buckle according to claim 10 wherein the spring is arranged so that the force needed to overcome the inertia of the button is up to around nine times the force needed to overcome the inertia of the securing means.

12. A buckle according to any one of the preceding claims wherein the latch is allowed to travel a small distance under pretensioning conditions but is inhibited from lifting fully out of tongue engagement by a spring loaded mass assembly behind the latch maintaining the position of the latch in normal conditions.

13. A buckle according to claim 12 comprising a calibration spring which is set so that blocking of the latch is achieved prior to the button moving.

14. A buckle according to any one of the preceding claims wherein the button is formed by an inner section and an outer section of a different mass, wherein the two sections move together under normal buckle working conditions, but, under pretensioning conditions, the inner button moves prior to the outer button.

25

15. A buckle according to claim 14 wherein the inner button has a small abutment which, under pretensioning conditions, fits over or clamps against the latch and prevents it from lifting and unlocking the buckle.

30

16. A buckle according to claim 15 wherein the

abutment comprises a composite material with a high coefficient of friction.

17. A buckle according to claim 14, 15 or 16 wherein
5 the mass of the inner button and the strength of the calibration spring are chosen to counteract the forces applied by the outer button to try to lift the latch to disengage the buckle.

10 18. A buckle for a vehicle safety restraint substantially as hereinbefore described with reference to figure 1 or figures 2a and 2b or figures 3 to 5 of the accompanying drawings.

15



Application No: GB 9719492.2
Claims searched: 1-17

Examiner: Philip Silvie
Date of search: 20 November 1998

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): E2A: ABB

Int Cl (Ed.6): A44B 11/25

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2 289 308 A (ALLIEDSIGNAL) see page 8, para. 2	1,5 at least
X	GB 2 241 019 A (AUTOFLUG) see page 10, para. 1	1,5 at least
X	EP 0 559 403 A1 (ALLIEDSIGNAL) see page 3, last para.	1,5 at least
X	EP 0 384 703 A1 (BSRD) see column 7, lines 35-42	1,5 at least
XE	US 5 704 099 A (TRW) see column 4, lines 41-50	1,5 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.